

10056623.020602
WHAT IS CLAIMED IS:

1. A liquid supply system which is provided with a liquid supply path to a liquid holding portion holding liquid at the downstream end in the supply direction of liquid and a filter in the liquid supply path and in which the liquid can be supplied from the upstream side of the filter to the downstream side thereof in the vertical direction in the direction of gravity, the system comprising:
 - 10 a member for dividing a portion of the filter in contact with the downstream side into a gas holding area and a liquid holding area; wherein the gas held in said gas holding area is in communication with gas present between the
 - 15 downstream side of the filter and the liquid holding portion in said downstream end.
2. A liquid supply system according to claim 1, wherein the liquid held in said gas holding area communicates with the liquid in said liquid holding portion thereby enabling reversible movement of the liquid at the upstream side of said filter and the liquid at the downstream side of said filter.
- 25 3. A liquid supply system according to claim 1, wherein the gas present between the downstream side of said filter and the upstream side of the liquid

holding portion at said downstream end is so positioned as to inhibit movement of a bubble from said liquid holding portion to said filter.

5 4. A liquid supply system according to claim 1, further comprising:

 a liquid connection structure for holding, at the downstream side of said filter in said liquid supply path, the liquid present at the downstream 10 side of said filter across the gas of said gas holding area by the surface tension of said liquid and connecting said liquid with the liquid at the upstream side of said filter.

15 5. A liquid supply system according to claim 4, wherein said liquid connecting structure includes a groove-shaped structure portion which is provided along the vertical direction and of which the upper end is almost in contact with the face of said filter 20 at the downstream side thereof.

 6. A liquid supply system according to claim 5, wherein the gap t between said groove-shaped structure portion and said filter is within a range 25 of $0 \leq t \leq 1.0$ mm.

 7. A liquid supply system according to claim 5,

10066623-02602

wherein said groove-shaped structure portion has a cross section of recessed shape.

8. A liquid supply system according to claim 5,
5 wherein said groove-shaped structure portion has a cross section of wedge shape.

9. A liquid supply system according to claim 5,
wherein said groove-shaped structure portion has an
10 arc-shaped liquid holding surface.

10. A liquid supply system according to claim 5,
wherein said groove-shaped structure portion has a member in which plural hollowing portions for holding
15 liquid are formed, and said member is provided at the downstream side of said filter.

11. A liquid supply system according to claim 5,
wherein said groove-shaped structure portion
20 satisfies a relation $L/S \geq 1000$ wherein L is the circumferential length of an area in contact with the liquid in said groove-shaped structure portion and S is the cross section of an area in contact with the liquid in said groove-shaped structure portion.

25

12. A liquid supply system according to claim 5,
wherein surrounding portion of said groove-shaped

10066623-020602

structure portion is cut off or rounded.

13. A liquid supply system according to claim 5,
wherein said groove-shaped structure portion is
5 integrally constructed with a member constituting
said liquid supply path at the downstream side of
said filter.

14. A liquid supply system according to claim 5,
10 wherein, at the downstream side of said filter, said
liquid supply path includes a cover member
constituting a lateral face of said liquid supply
path and a main body member constituting another face
of said liquid supply path and jointed to said cover
15 member, and said groove-shaped structure portion is
provided at least on said cover member.

15. A liquid supply system according to claim
14, wherein said cover member and said main body
20 member are jointed with adhesive, and the groove-
shaped structure portion provided on said cover
member is provided as a protruding portion with a
slit, protruding from the adhered face of said cover
member with said main body member and holding the
25 liquid by the surface tension thereof.

16. A liquid supply system according to claim

10066623.02602

15, wherein said protruding portion is provided with a groove for receiving said adhesive between the adhered face of said cover member with said main body member and said slit.

5

17. A liquid supply system according to any of claims 1 to 16, wherein said liquid supply path has a first liquid chamber at the upstream side of said filter and a second liquid chamber including the gas 10 of said gas holding area at the downstream side of said filter.

18. A liquid supply system according to claim 17, wherein said first liquid chamber includes 15 pressure adjusting means for absorbing pressure variation in said first liquid chamber.

19. A liquid supply system according to claim 17, further comprising, at the upstream side of said 20 first liquid chamber in said liquid supply path, a valve structure to be opened at the normal liquid supply state and to be closed at the liquid filling into said second liquid chamber by suction from said downstream end.

25

20. A liquid supply system according to claim 17, wherein said first liquid chamber includes an air

10066623-020602

communication aperture which can be opened and closed and is to be closed at the liquid filling into said second liquid chamber by suction from said downstream end.

5

21. A liquid supply system according to claim 17, further comprising, at the downstream side of said filter in said liquid supply path, a third liquid chamber for holding the liquid in such a 10 manner that the liquid is in contact with a part of the surface of said filter at the downstream side thereof.

22. A liquid supply system according to claim 15 21, wherein said third liquid chamber includes a structure for holding the liquid by the surface tension thereof in contact with the surface of said filter at the downstream side thereof.

20 23. A liquid supply system according to claim 22, wherein the structure for causing the liquid of said third liquid chamber to contact the surface of said filter at the downstream side thereof includes at least a rib so provided that the front end thereof 25 is in contact with the surface of said filter at the downstream side thereof.

10066623-020602

24. A liquid supply system according to claim 21, wherein the amount of the liquid that can be held in said third liquid chamber is larger than the amount of change in the volume of the gas in said gas holding area anticipated in the environment of use.

25. A liquid supply system according to claim 21, wherein said third liquid chamber is so provided as to surround an aperture connecting said filter and said second liquid chamber.

26. An ink jet recording head provided with a first liquid chamber and a second liquid chamber separated by a filter and respectively containing liquid therein, and a liquid discharge portion connected directly with said second liquid chamber and adapted to discharge the liquid supplied from said second liquid chamber, in which the liquid can be supplied from said first liquid chamber to said second liquid chamber through said filter, comprising:

25 a member for dividing a portion of the filter in contact with said second liquid chamber into a gas holding area and a liquid holding area; wherein the gas held in said gas holding area is in communication with the gas present in said second liquid chamber.

10066623 - 020602

27. An ink jet recording head according to claim 26, wherein the liquid held in said liquid holding area communicates with the liquid in said liquid chamber thereby enabling reversible movement of the 5 liquid in said first liquid chamber and the liquid in said second liquid chamber.

28. An ink jet recording head according to claim 26, wherein the gas present in said second 10 liquid chamber is so positioned as to inhibit movement of a bubble from said liquid discharge portion to said filter.

29. An ink jet recording head according to claim 26, further comprising a liquid connection 15 structure for holding the liquid present in said second liquid chamber across the gas of said gas holding area by the surface tension of said liquid and connecting said liquid with the liquid in said 20 first liquid chamber through said filter.

30. An ink jet recording head according to claim 29, wherein said liquid connecting structure includes a groove-shaped structure portion which is 25 provided along the liquid supply direction from said first liquid chamber to said second liquid chamber and of which the upper end is almost in contact with

10056623.020602

the surface of said filter at the downstream side thereof.

31. An ink jet recording head according to
5 claim 30, wherein the gap t between said groove-
shaped structure portion and said filter is within a
range of $0 \leq t \leq 1.0$ mm.

32. An ink jet recording head according to
10 claim 30, wherein said groove-shaped structure
portion has a cross section of recessed shape.

33. An ink jet recording head according to
claim 30, wherein said groove-shaped structure
15 portion has a cross section of wedge shape.

34. An ink jet recording head according to
claim 30, wherein said groove-shaped structure
portion has an arc-shaped liquid holding surface.

20
35. An ink jet recording head according to
claim 30, wherein said groove-shaped structure
portion has a member in which plural hollowing
portions for holding liquid are formed, and said
25 member is provided at the downstream side of said
filter.

10066623-020602

36. An ink jet recording head according to
claim 30, wherein said groove-shaped structure
portion satisfies a relation $L/S \geq 1000$ wherein L is
the circumferential length of an area in contact with
5 the liquid in said groove-shaped structure portion
and S is the cross section of an area in contact with
the liquid in said groove-shaped structure portion.

37. An ink jet recording head according to
10 claim 30, wherein surrounding portion of said groove-
shaped structure portion is cut off or rounded.

38. An ink jet recording head according to
claim 30, wherein said groove-shaped structure
15 portion is integrally constructed with a member
constituting said second liquid chamber.

39. An ink jet recording head according to
claim 30, wherein said second liquid chamber includes
20 a cover member constituting a lateral face of said
second liquid chamber and a main body member
constituting another face of said second liquid
chamber and jointed to said cover member, and said
groove-shaped structure portion is provided at least
25 on said cover member.

40. An ink jet recording head according to

10066623.020602

claim 39, wherein said cover member and said main body member are jointed with adhesive, and the groove-shaped structure portion provided on said cover member is provided as a protruding portion with 5 a slit, protruding from the adhered face of said cover member with said main body member and holding the liquid by the surface tension thereof.

41. An ink jet recording head according to 10 claim 40, wherein said protruding portion is provided with a groove for receiving said adhesive between the adhered face of said cover member with said main body member and said slit.

15 42. An ink jet recording head according to claim 26, wherein said first liquid chamber includes pressure adjusting means for absorbing pressure variation in said first liquid chamber.

20 43. An ink jet recording head according to claim 26, further comprising a connecting portion to which the liquid supply means to said first liquid chamber is detachably connected.

25 44. An ink jet recording head according to claim 26, further comprising, between said first liquid chamber and said second liquid chamber, a

10056623.020602

third liquid chamber for holding the liquid in such a manner that the liquid is in contact with a part of the surface of said filter at the side of said second liquid chamber.

5

45. An ink jet recording head according to claim 44, wherein said third liquid chamber includes a structure for holding the liquid by the surface tension thereof in contact with the surface of said 10 filter.

46. An ink jet recording head according to claim 45, wherein the structure for causing the liquid of said third liquid chamber to contact the 15 surface of said filter includes at least a rib so provided that the front end thereof is in contact with the surface of said filter at the side of said second liquid chamber.

20 47. An ink jet recording head according to claim 44, wherein the amount of the liquid that can be held in said third liquid chamber is larger than the amount of change in the volume of the gas in said 25 gas holding area anticipated in the environment of use.

48. An ink jet recording head according to

10056623-020602

claim 44, wherein said third liquid chamber is so provided as to surround an aperture connecting said filter and said second liquid chamber.

5 49. An ink jet recording apparatus comprising:
support means for supporting an ink jet recording head according to any of claims 26 to 48;
suction means for forcedly sucking ink in said ink jet recording head from the liquid discharge portion
10 thereof; and
a valve mechanism for opening or closing of the first liquid chamber of said ink jet recording head to or from the exterior thereof.

15 50. An ink jet recording apparatus according to claim 49, further comprising:
an ink supply unit on which an ink tank containing ink is detachably mounted and which serves to supply the ink in said ink tank to said ink jet recording head through a tube;
wherein said valve mechanism is provided in an ink supply path from said ink tank to said ink jet recording head.

25 51. An ink jet recording head according to claim 49, wherein said first liquid chamber includes an air communicating aperture, and said valve

10066623.020502

mechanism controls to open or close said air communicating aperture.

52. A liquid filling method for use in a
5 liquid supply system in which first and second liquid
chambers respectively holding liquid are separated by
a filter while liquid is held at the downstream side
of said second liquid chamber in the liquid supply
direction from said first liquid chamber to said
10 second liquid chamber, a member is provided for
separating a contact portion of the downstream side
of said filter into a gas holding area and a liquid
holding area in a state capable of liquid supply from
the upstream side of said filter to the downstream
15 side thereof in the vertical direction of gravity,
and the gas held in said gas holding area is in
communication with the gas present between the
downstream side of said filter and the upstream side
of the liquid holding area at said downstream end,
20 the method comprising:
a step of closing the first liquid chamber from
the exterior;
a step of executing suction from the downstream
side of said second liquid chamber in a state where
25 said first liquid chamber is closed, thereby reducing
the pressure of said first and second liquid
chambers; and

10066623-020602

a step, after the pressure reduction of said first and second liquid chambers, of opening said first liquid chamber to the exterior.

10066623.020602